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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/635,507	08/09/2000	Krishnaswamy Ramkumar	CYPR-PM00005	5685

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EXAMINER
ANDERSON, MATTHEW A

ART UNIT	PAPER NUMBER
1765	

DATE MAILED: 10/04/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

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Offic Action Summary	Application No. 09/635,507	Applicant(s) RAMKUMAR ET AL.	
	Examiner Matthew A. Anderson	Art Unit 1765	

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *08 August 2002* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-20 and 22-28* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-20 and 22-28* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1-4, 7-12, 14, 17-20, 23, 25-26 are rejected under 35 U.S.C. 102(e) as being anticipated by Thei et al. (US 6,350,662 B1).

Thei et al. discloses a method to reduce defects in shallow trench isolations by post liner anneal. The substrate has reduced defects by a nitrogen anneal. A silicon substrate is provided. Etching is used (RIE which stands for reactive ion etching) on the substrate to form the shallow trenches with corners seen in Fig. 4.. A liner silicon oxide layer (LINOX of the applicant's claims) is grown by wet oxidation at between about 800-900 degrees C on the interior surfaces of the shallow trenches. The substrate and liner are annealed to reduce or eliminate defects, dislocations, interface traps, and stress in the silicon substrate. This inherently must mean that the stress in the liner oxide are also reduced since the liner is formed on the substrate. The anneal takes place in N_2 at a temperature of between about 1000 to 1150 degrees C. (see col. 4 lines 1-10) A silicon oxide isolation layer is then (i.e. subsequently) deposited (i.e. backfilled) by CVD (see col. 4 lines 20-30) over the liner layer and completely filling the shallow trenches.

(see abstract for the above). Then, as in col. 4 lines 44-55, after planarization by CMP, polysilicon features are deposited and defined (i.e. etched) by processing steps typical in the art over the isolation structure thus formed. Thei et al. discloses the anneal as a way of reduction defects and breakdown of the isolation. The leakage in a semiconductor device is an inherent result of the breakdown of the oxide isolation. (see col. 1 and 2 lines 60+ and 1-20, respectively) RIE was known to be inherently a plasma process for etching trenches. (see Akatsu et al. US 6,319,794 B1 col. 6 lines 54-60.)

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 5, 15, 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Thei et al. as applied to claims 1-4, 7-12, 14, 17-20, 23, 25, 27 above, and further in view of Wolf et al., Silicon Processing in the VLSI Era, Volume 1: Process Technology, Lattice Press, Sunset Beach, CA, USA, pp. 56-70.

Thei et al. does not explicitly state that the annealing step denudes or getters at least one of the substrate or the liner oxide.

Wolf et al. discloses on page 66 in advantage a) that thermal annealing was a known method for forming denuded areas as a part of intrinsic gettering processes.

It would have been obvious to one of ordinary skill in the art at the time of the present invention to combine the knowledge of Wolf with that of Thei et al. because Wolf et al. further discloses the affects of the annealing performed by Thei et al. to include denuding and gettering.

5. Claims 6, 13, 22, 24, 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Thei et al. as applied to claims 1-4, 7-12, 14, 17-20, 23, 25, 27 above, and further in view of Ishikawa et al. (US 6,277,706 B1).

Thei et al. is described above.

Thei et al. does not disclose explicitly that the anneal reduces stresses in the liner layer.

Ishikawa et al. discloses a method of manufacturing isolation trenches utilizing an additional silicon nitride layer. In cols. 3-4 lines 50+ and 1-14 is described the annealing of silicon oxide to make a tighter structure. This tighter structure is defined in col. 3 lines 20-30 to mean densification of the silicon oxide. In col. 5 lines 25-50 describes that a properly annealed and thereby densified silicon oxide will avoid stresses in the trenches, reduce faults in the substrate, and surely isolate individual circuit elements.

It would have been obvious to one of ordinary skill in the art at the time of the present invention to combine Thei et al. with Ishikawa et al. because the latter discloses annealing methods which result in the avoidance of stresses in the trenches, the

reduction of faults in the substrate, and the sure formation of isolated individual circuit elements.

It would have been obvious to one of ordinary skill in the art at the time of the present invention that the annealing of Thei et al. reduces stresses, increases densification, in the liner silicon oxide layer because Ishikawa et al. discloses such in a silicon oxide layer thus annealed, and such annealing would have been anticipated to produce an expected result.

6. Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Thei et al. as applied to claims 1-4, 7-12, 14, 17-20, 23, 25-26 above

Thei et al. is described above.

Thei et al. does not explicitly disclose the thickness of the trench.

It would have been obvious to one of ordinary skill in the art at the time of the present invention to optimize the thickness of the trench because oxide breakdown was a known property of oxide layers and due to capacitance effects, is related to the thickness of the dielectric (here, the oxide), such optimization would have been achieved with only routine experimentation and would have been anticipated to produce a expected results.

Response to Arguments

7. Applicant's arguments filed 8/14/2002 have been fully considered but they are not persuasive.

The examiner disagrees with the applicant's characterization of the timing of the anneal step. The abstract suggests forming a trench, growing a liner oxide, annealing the liner oxide and the substrate, and lastly depositing an isolation oxide layer overlying the liner oxide and completely filling the trench. This sequence is again shown in Figs. 4-7. The description of col. 3 lines 29+ and col. 4 lines 1-28 discloses just this preferred sequence of processing. The claim that there is a distinction between Thei and the present invention in this sequencing is not convincing in light of the evidence.

The examiner notes the statements of the applicant on page 6 of paper 4. These are moot since they deal only with a process were annealing takes place with both the liner and the bulk oxide present and that is not the case with the cited reference of Thei.

Conclusion

7. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew A. Anderson whose telephone number is (703) 308-0086. The examiner can normally be reached on M-Th, 6:30-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Benjamin Utech can be reached on (703) 308-3836. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9310 for regular communications and (703) 872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.

MAA
October 2, 2002

BENJAMIN L. UTECH
SUPERVISORY PATENT EXAMINER
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